Learnova

AI-Powered Audiobook & E-Learning Platform

Graduation Project

Faculty of Engineering — Systems & Computers Engineering

Al-Azhar University

Prepared By: Reham Ehab, Mariam Mohamed, Norhan Abdelrahman, Hend Mohamed, Wafaa Yousry & Salma Ibrahim

Supervised By: Dr. Sayed Noah

Abstract

A unified AI-powered learning experience

Digital Library

A structured catalog of books, authors and categories.

AI Assistant

Context-aware chat that answers questions grounded in book content.

Audiobooks

Text-to-speech narration with a full-featured media player.

Courses

Video lessons, PDFs and quizzes in one learning flow.

Learnova is an AI-powered educational platform that integrates intelligent semantic search, audiobook narration, AI summarization, personalized recommendations and an interactive learning assistant into a single mobile experience — built with Flutter on the frontend and Laravel with a Python AI microservice layer on the backend.

Agenda

What we will walk through today

01

Introduction & Problem

02

System Architecture

03

Backend (Laravel)

04

Flutter Application

05

AI Engine

06

Testing

07

Live Demo

08

Results & Future Work

Problem Statement

Why traditional e-reading falls short

Traditional Learning

Large Unstructured PDFs

Finding information is time-consuming and inefficient.

Keyword-Based Search

Cannot understand the actual meaning or context.

No Intelligent Assistance

No summaries, explanations, or interactive Q&A.

No Audio Learning

Users must read everything manually.

Fragmented Learning Experience

Multiple platforms are required for reading, listening, and learning.

Learnova

Semantic AI Search

Retrieves information based on meaning and context.

Personalized Recommendations

Suggests books and courses tailored to each user.

AI Audiobook Experience

Listen to books with built-in narration and playback controls.

Context-Aware AI Assistant

Ask questions, generate summaries, and explore concepts instantly.

All-in-One Learning Platform

Reading, listening, and learning unified in a single app.

Where Learnova Fits

How existing tools fall short of a unified AI learning platform

Existing Solutions

- Google Drive → File Storage Only
- Adobe Acrobat → PDF Reader
- Audible → Audiobooks Only
- Coursera → Courses Only
- ChatGPT → No document context

Learnova

- AI-powered Knowledge Platform
- Semantic Search + AI Chat
- Audiobooks + AI + Courses
- Courses + Books + AI Assistant
- Context-aware answers from your library

Objectives

Six core capabilities the platform delivers

Digital Library

Organized catalog of books across categories and authors.

AI Chat

Ask questions and get answers grounded in the book's content.

AI Summary

Short and detailed AI-generated summaries per book.

Semantic Search

Meaning-based search, not just keyword matching.

Audiobooks

Text-to-speech narration with a full media player.

Recommendations

Personalized suggestions based on reading behavior.

Target Users

Who Learnova is built for

Students

Faster comprehension and revision through AI summaries.

Teachers

Structured courses with lessons, PDFs and quizzes.

Readers

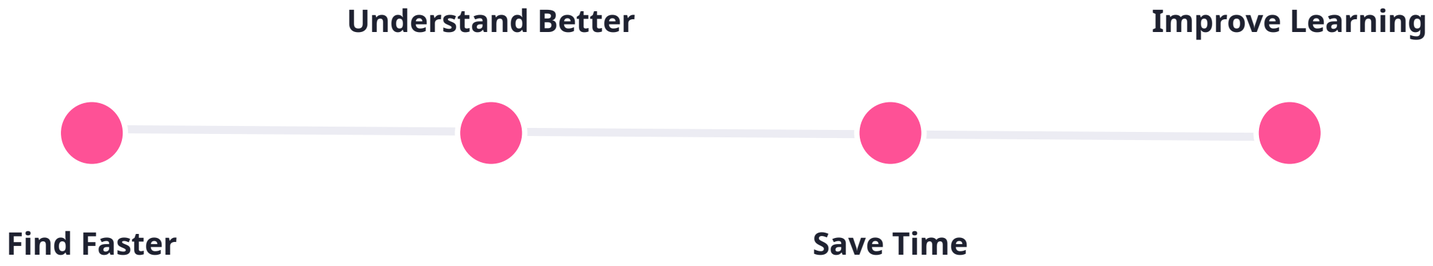
Audiobooks and semantic discovery of new titles.

Professionals

On-the-go learning through audio and quick summaries.

Expected Benefits

The value chain from search to learning outcome



Impact

Faster access to relevant content through semantic search

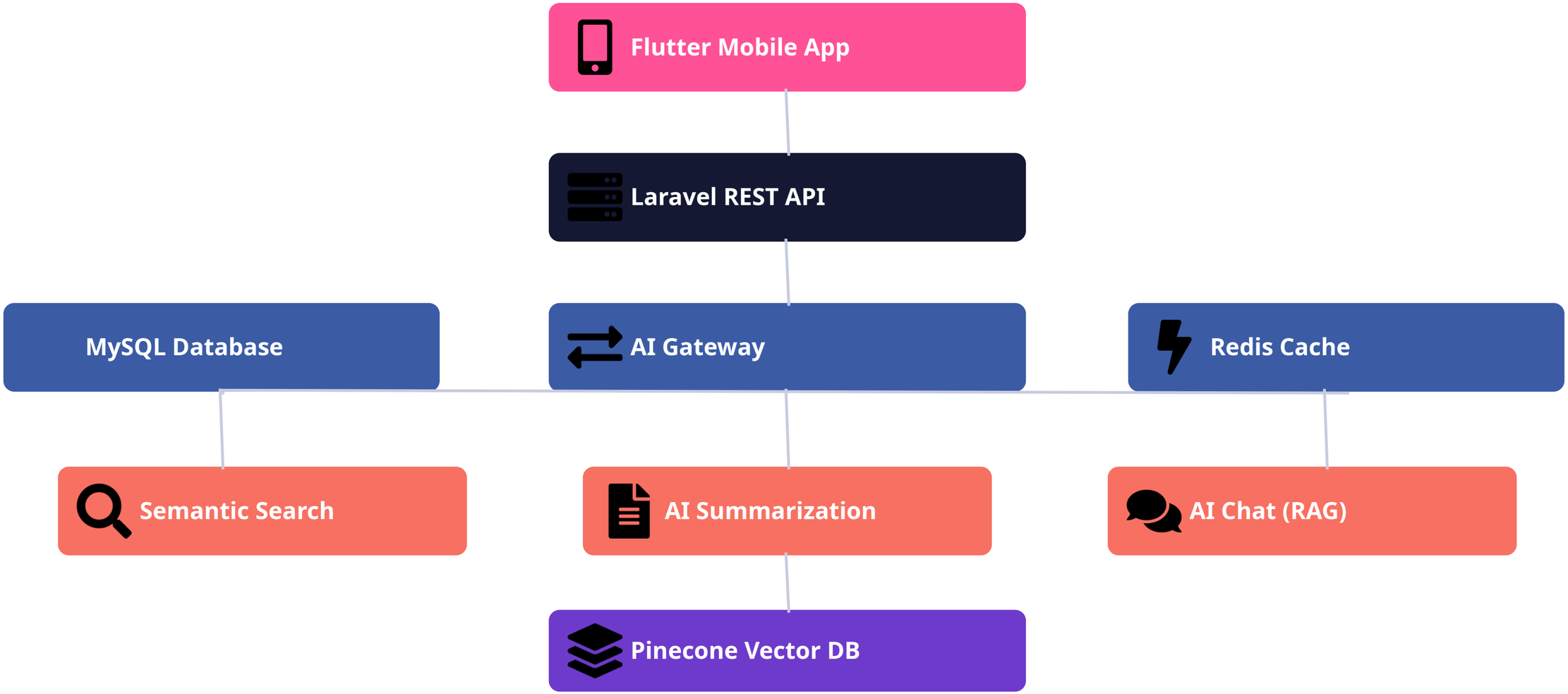
Deeper understanding via AI summaries and chat

Significant time saved compared to manual reading

Stronger learning outcomes across course material

Overall System Architecture

Three-tier design: Flutter, Laravel, and Python AI services



Technology Stack

Tools and frameworks powering Learnova end-to-end

Flutter

Laravel 12

Python

MySQL 8

Redis

Pinecone

Kafka

Groq Llama 3.3

Docker

Git

FilamentPHP

BLoC

02

Backend Architecture

Robust, Secure & Scalable Backend

Laravel 11

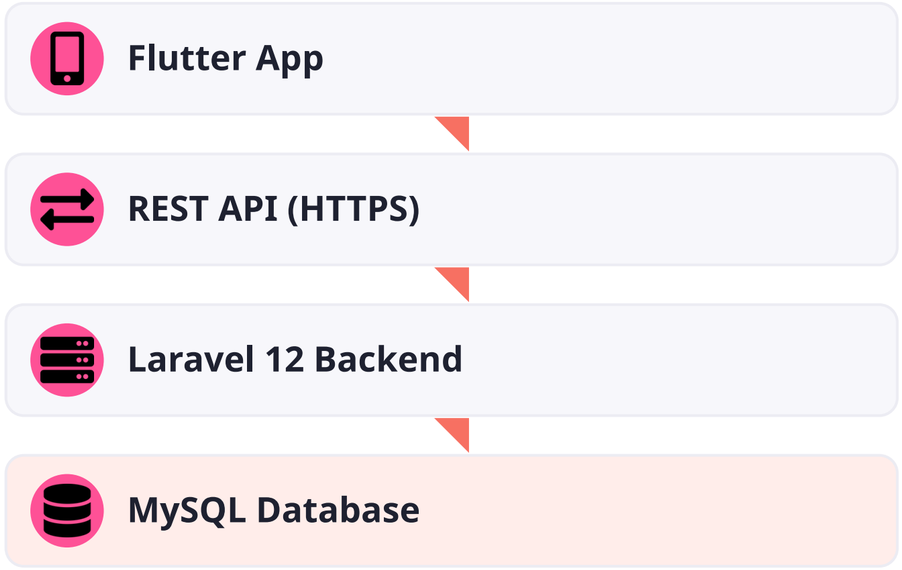
REST API

MySQL

Sanctum Auth

Backend Overview

Request flow from client to database



Backend Highlights

- Laravel 12 with modular controllers
- RESTful API design across all resources
- Clean MVC architecture

Laravel Architecture

Layered structure for maintainability

Backend Tools

Built with Flutter best practices

Laravel 12 bloc

PHP framework for building RESTful APIs and acting as AI Proxy Gateway.

MySQL 8.0

Relational database for storing users, books, courses, and metadata.

FilamentPHP 3

Beautiful admin panel for content and user management.

Laravel Sanctum

Token-based authentication and API security.

Docker

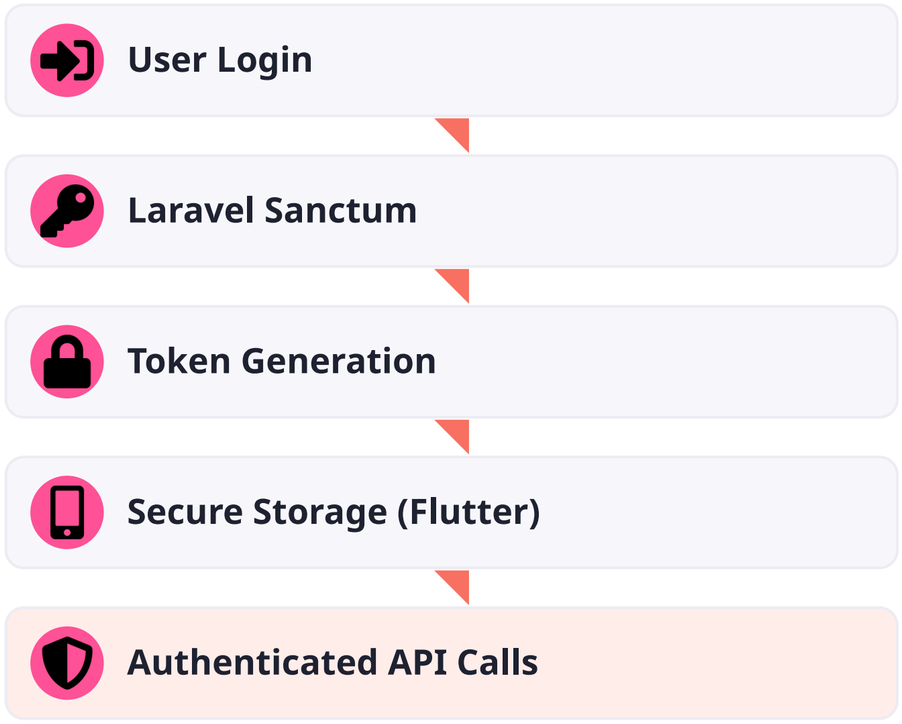
Containerization for consistent development and deployment.

Git & GitHub

Version control and collaboration.

Authentication Flow

Token-based authentication with Laravel Sanctum

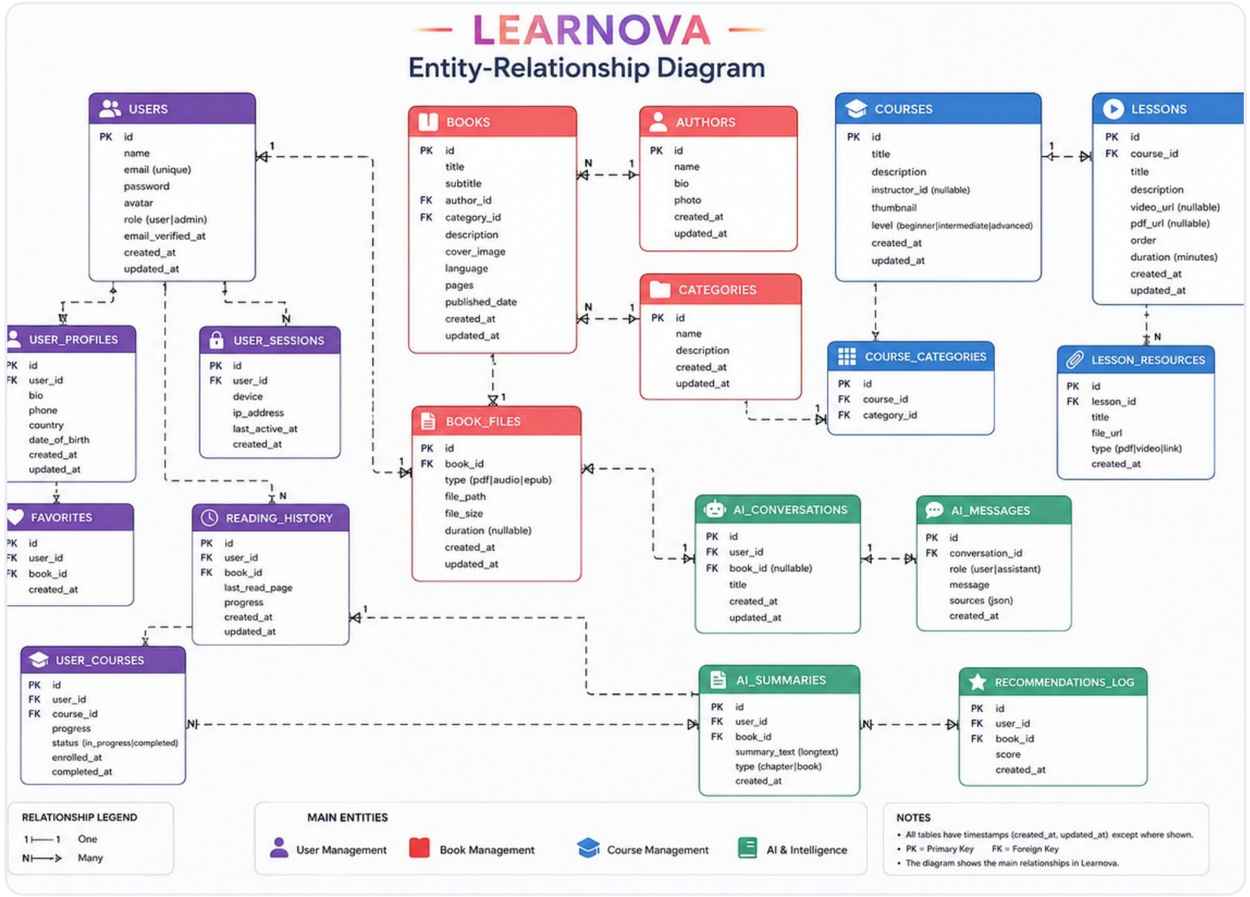


Also Supported

- Role-based access: Admin, Researcher, Student
- OTP-based password reset
- Google & Facebook social login

Database Design

Relational schema behind the platform



Main Entities

- Users
- Books
- Courses
- Course Lessons
- Reviews
- Bookmarks / Shelves
- AI Metadata

REST API Design

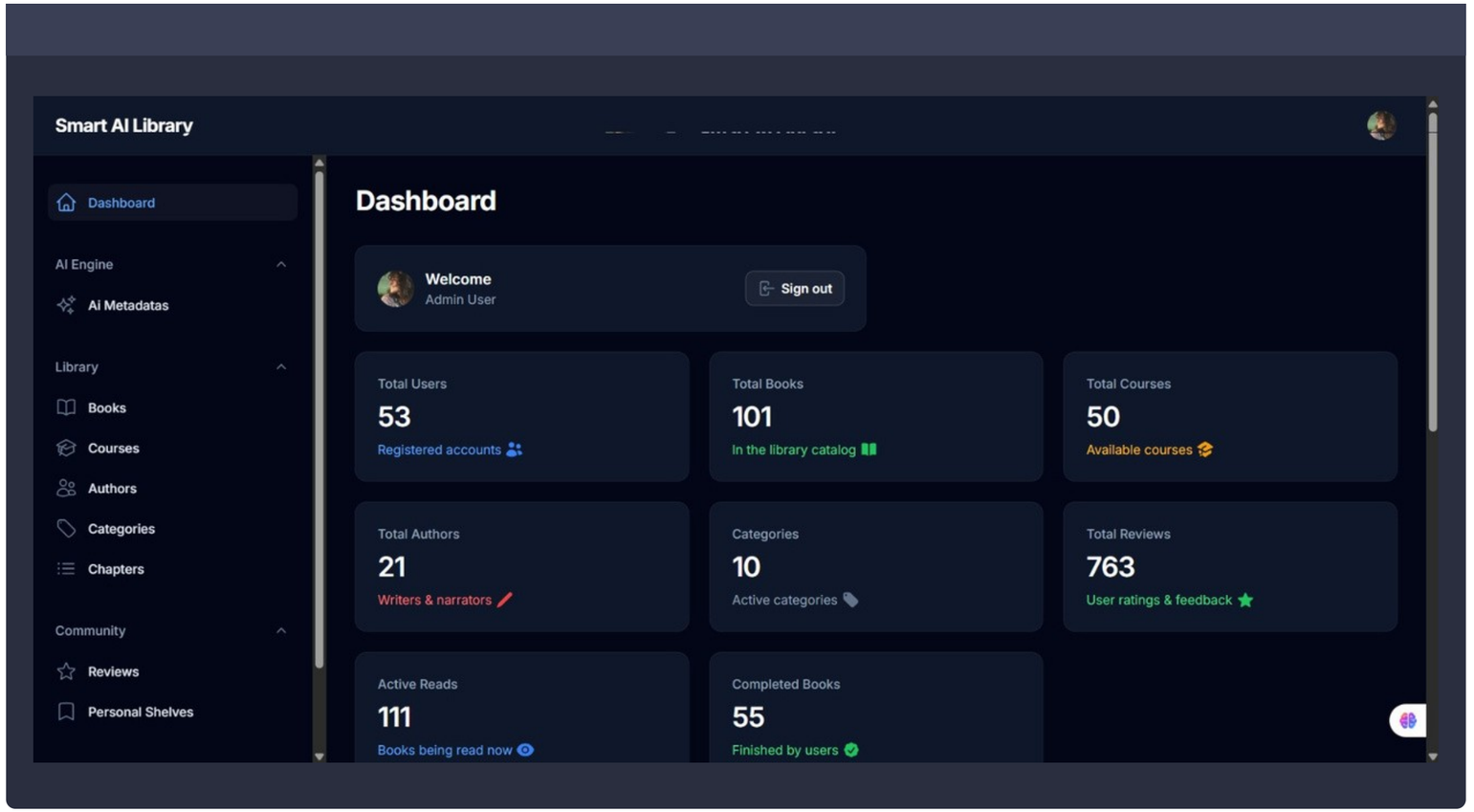
Resource-oriented endpoints across the platform

- Authentication
- Books
- Courses
- Authors
- Favorites
- Search
- AI
- Recommendations

Flutter → HTTP Request → Laravel → JSON Response

Admin Dashboard

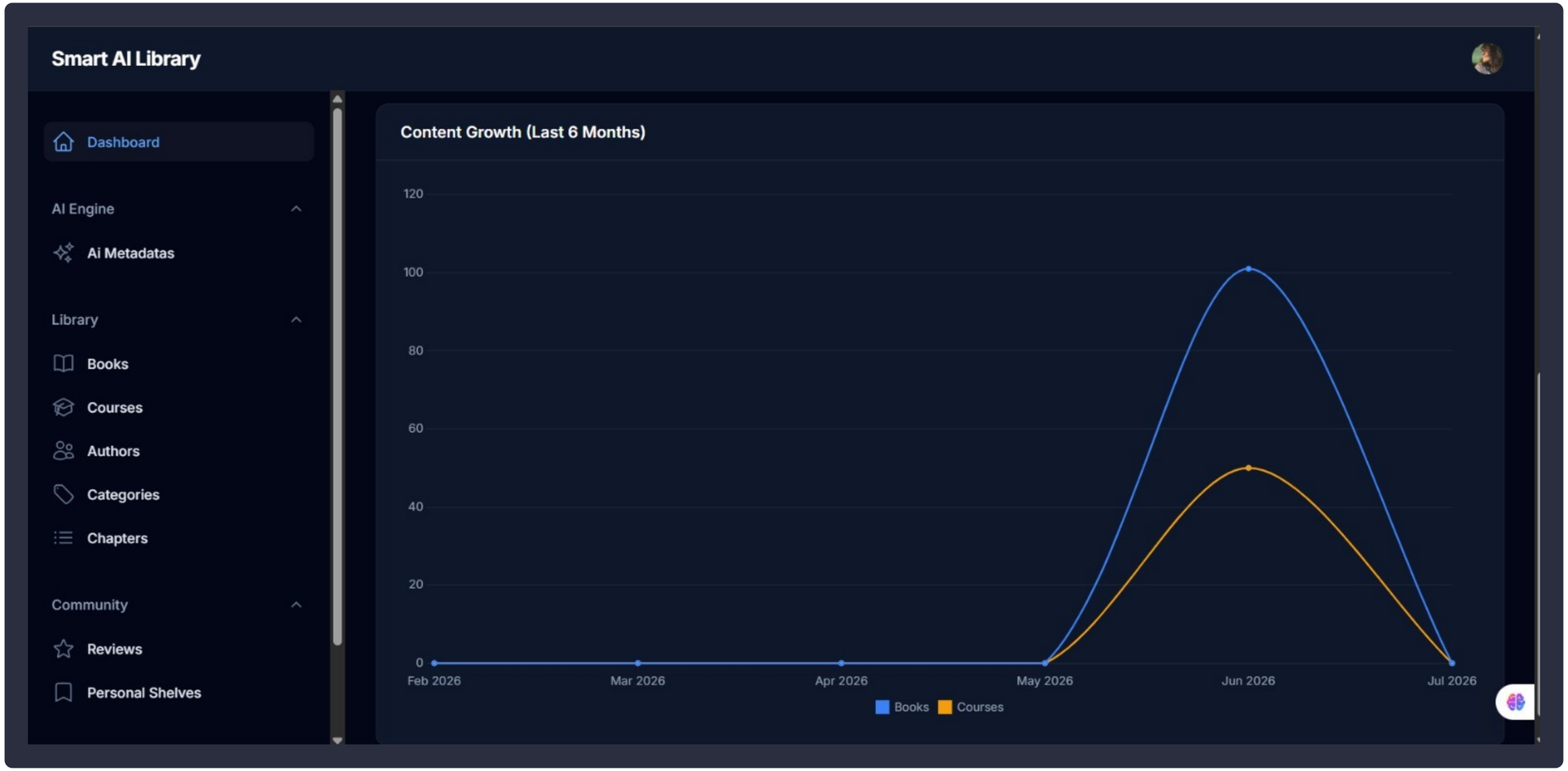
Full visibility over content and users



- **User Management**
- **Book Management**
- **Course Management**
- **Analytics**
- **Reports**

Content Growth Analytics

Tracking library growth over time



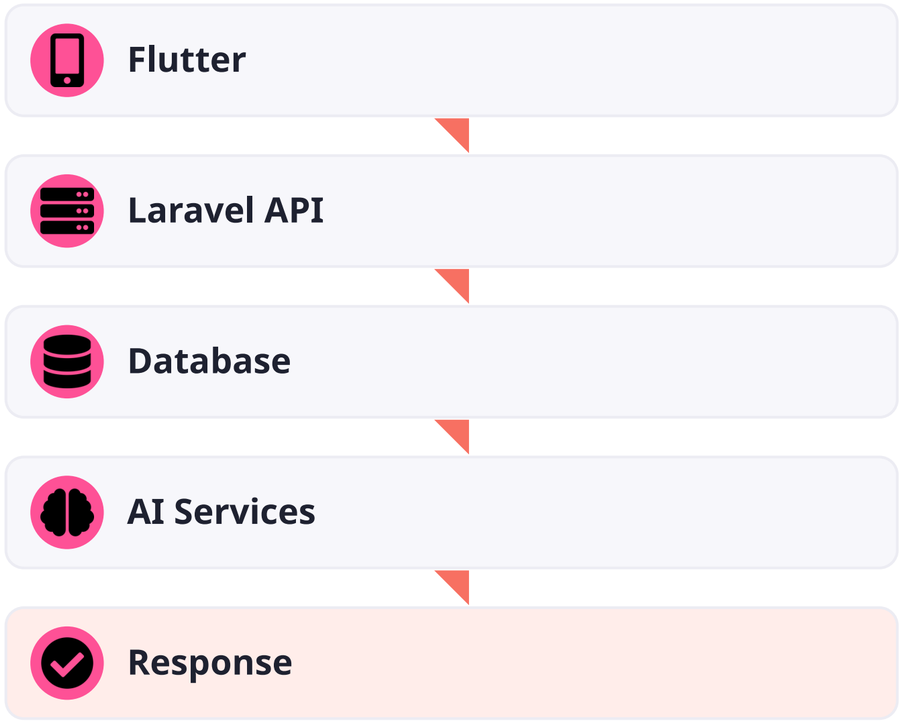
Security

Defense at every layer of the API

- **Laravel Sanctum authentication**
- **Request validation on every endpoint**
- **Token-based authorization**
- **Unauthorized access protection**
- **Rate limiting on sensitive routes**

Backend Summary

From request to response



Achievements

- Fast
- Secure
- Modular
- Scalable & Maintainable

03

Flutter Application

Cross-Platform Mobile Experience

Clean Architecture

BLoC

go_router

Material Design

Flutter Clean Architecture

Separation of concerns across three layers

Flutter Tools

Built with Flutter best practices

flutter_bloc

State management using Cubit & BLoC pattern for predictable and testable state handling.

go_router

Declarative navigation and deep linking with support for nested routes and guards.

syncfusion_flutter_pdfviewer

Inline PDF rendering and viewing inside the app.

flutter_screenutil

Responsive UI sizing (sp/w/h) for different screen sizes.

dio

Powerful HTTP client with interceptors, retry, and logging.

flutter_tts

Text-to-Speech engine for audiobook narration (Android/iOS).

cached_network_image

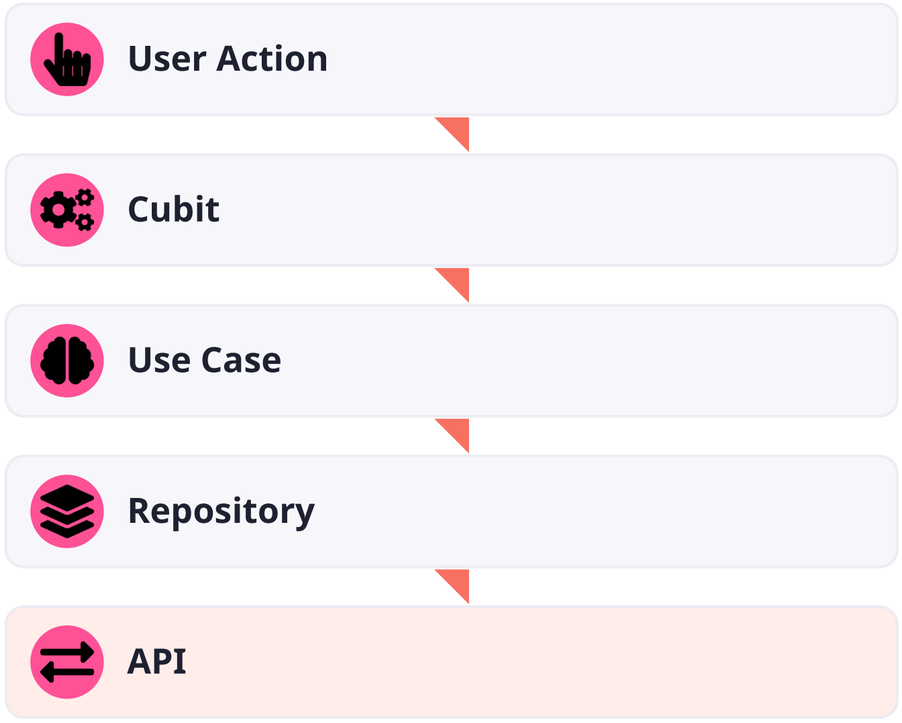
Cached network images with fade-in animation and placeholder.

easy_localization

Multi-language support (Arabic / English localization).

State Management (BLoC)

Predictable state flow for every user action



Why BLoC

- Predictable, testable state
- Clean separation of concerns
- Easy unit testing

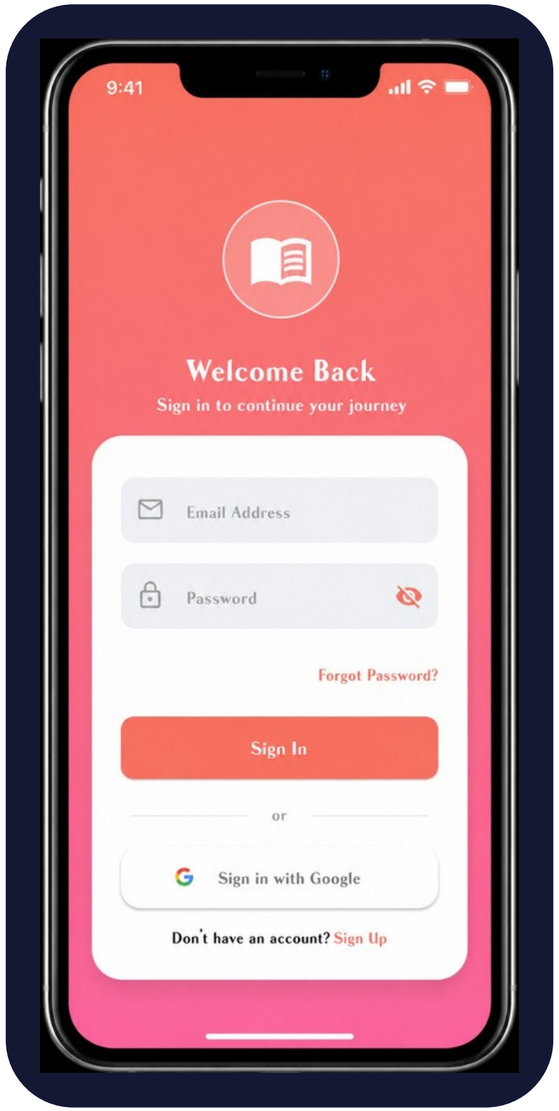
Navigation Flow

Primary screen-to-screen journey

Splash **Login** **Home** **Book Details** **AI Chat** **Player** **Profile**

Login Screen

Secure entry point to the platform

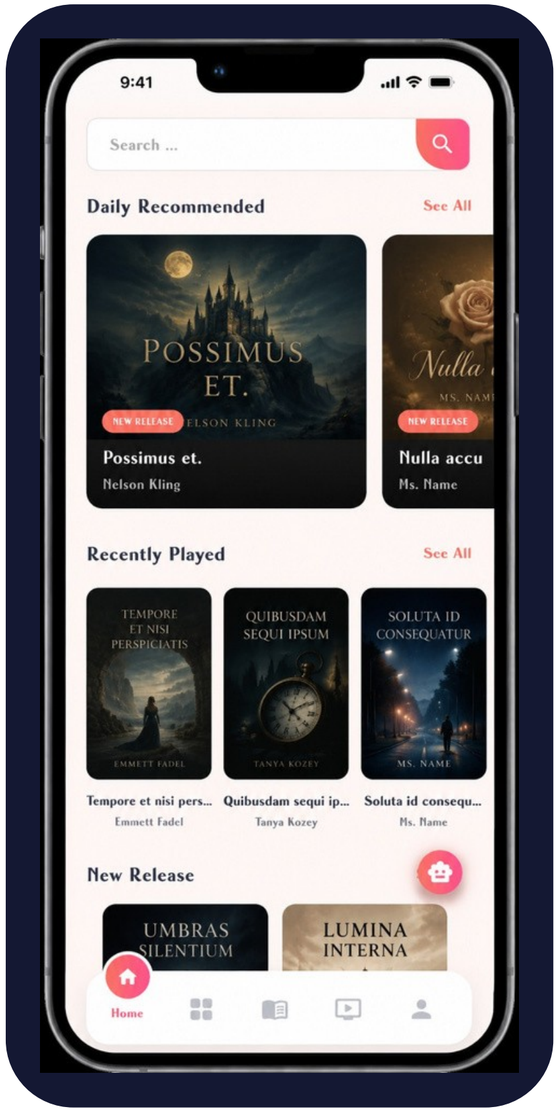


- **Email & password sign-in**
- **Google sign-in option**
- **Forgot password recovery**
- **Token-based session on success**

Sanctum-secured authentication

Home Screen

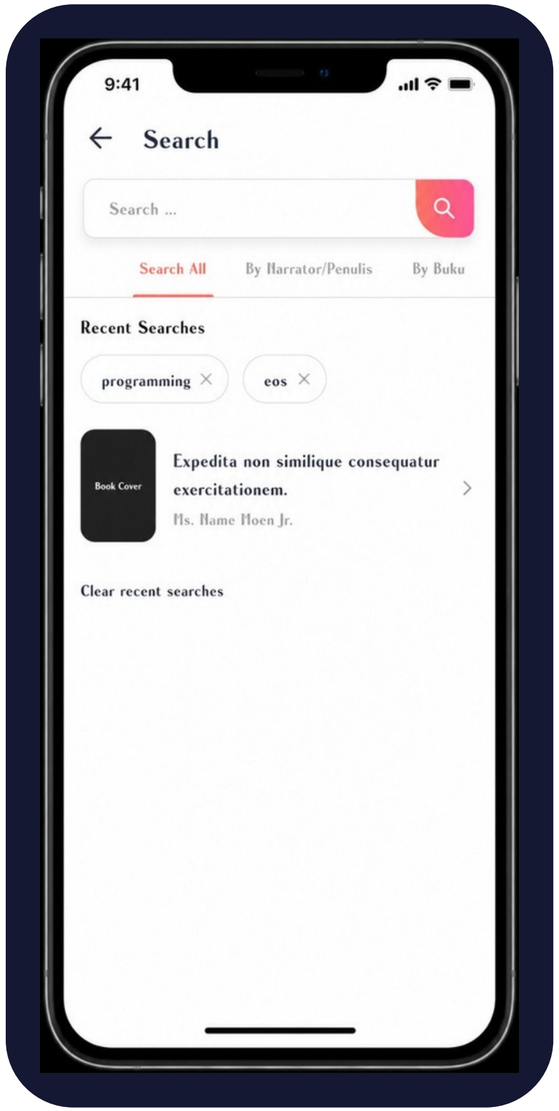
The starting point of the learning journey



- **Categorized browsing**
- **Quick search access**
- **Continue reading / recently played**
- **Daily recommended picks**

Search Screen

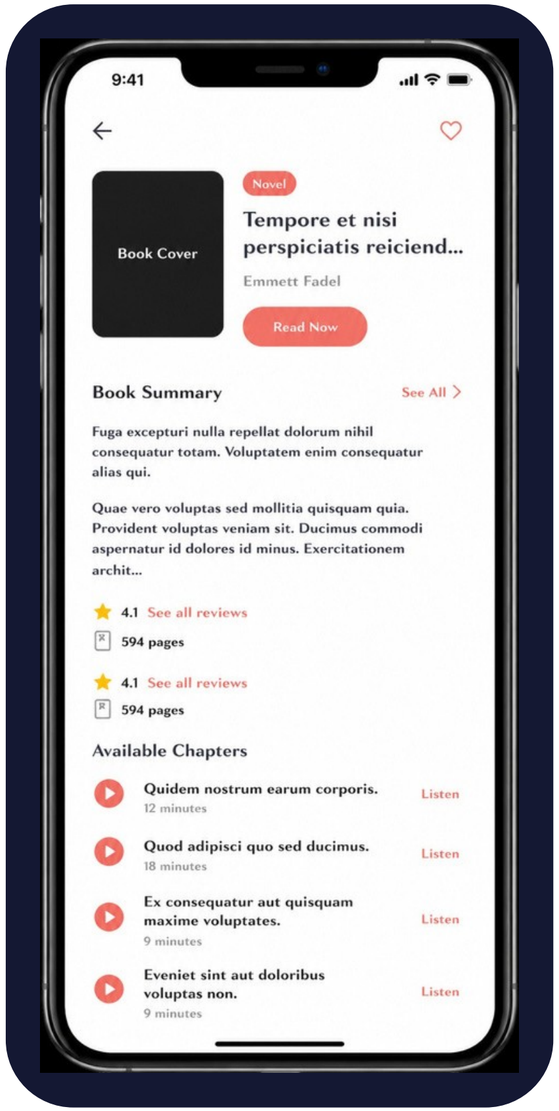
Finding content that matters, faster



- **Unified search across books**
- **Filter by narrator / writer**
- **Recent search history**
- **Direct navigation to results**

Book Details

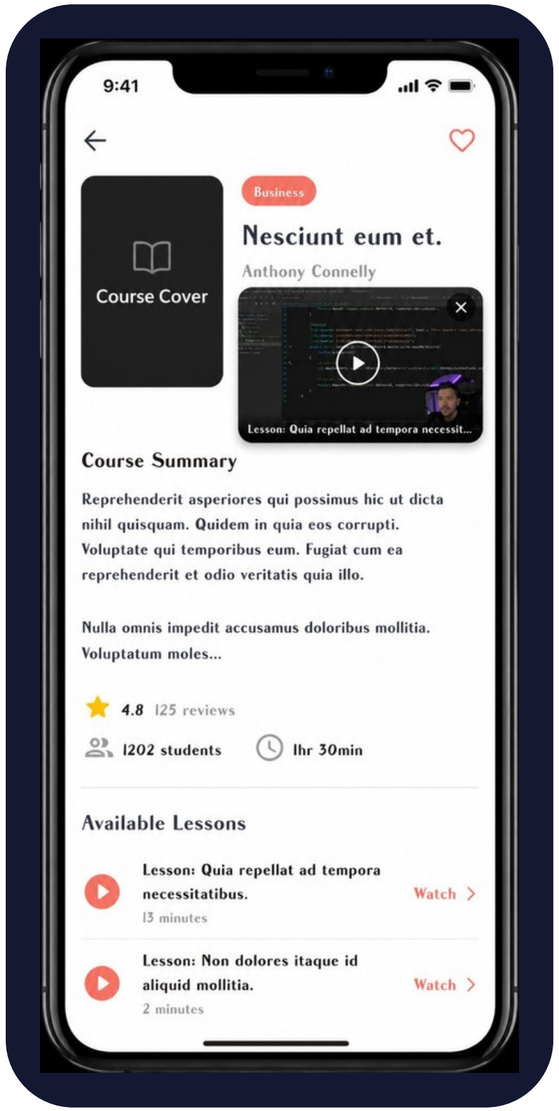
Everything about a title, in one place



- **Book information & rating**
- **Audio chapters ready to play**
- **AI summary access**
- **AI chat about this book**
- **Add to favorites**

Course Details

Structured lessons for guided learning


9:41
Business
Nesciunt eum et.
Anthony Connelly
Course Cover
Lesson: Quia repellat ad tempora necessit...
Course Summary
Reprehenderit asperiores qui possimus hic ut dicta nihil quisquam. Quidem in quia eos corrupti. Voluptate qui temporibus eum. Fugiat cum ea reprehenderit et odio veritatis quia illo.
Nulla omnis impedit accusamus doloribus mollitia. Voluptatum moles...
4.8 125 reviews
1202 students
1hr 30min
Available Lessons
Lesson: Quia repellat ad tempora necessitatibus.
13 minutes
Watch
Lesson: Non dolores itaque id aliquid mollitia.
2 minutes
Watch

- **Video lessons**
- **Add to favorites**
- **Ratings & enrolled students**
- **Progress-friendly lesson list**

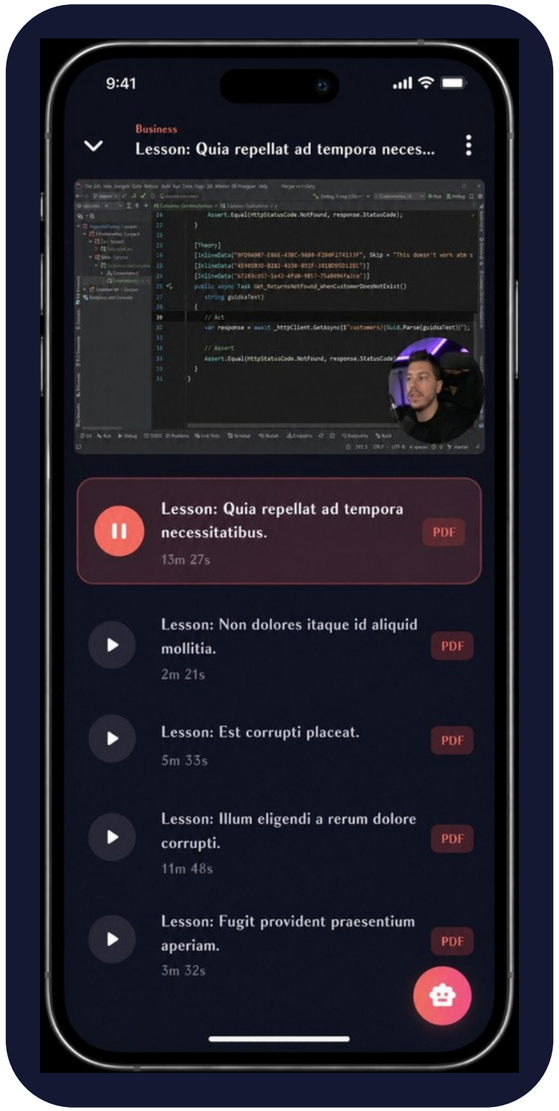
Audio Experience

Mini player architecture for uninterrupted listening

- **Full-screen media player**
- **Background playback**
- **Playback speed control**
- **Favorite & share**

Lesson Player

Course video playback with lesson navigation



- **Embedded video lessons**
- **AI chat access**
- **Lesson duration at a glance**
- **Sequential lesson list**

Flutter Features Summary

Built with Flutter best practices

Responsive UI

BLoC State Management

Clean Architecture

REST API Integration

AI Integration

Audio Player

Dark Theme Support

Local Caching

04

Artificial Intelligence Engine

Intelligent Learning Powered by AI

Semantic Search

AI Chat

Summarization

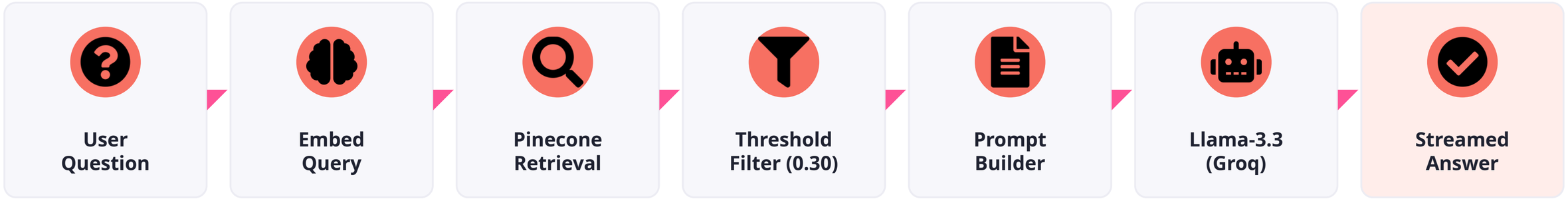
Recommendations

AI Pipeline

From raw book file to grounded AI response

Retrieval-Augmented Generation (RAG)

Grounding every answer in real book content



Built with LangChain: passages scoring below a 0.30 similarity threshold are discarded before reaching the Llama-3.3-70B (Groq) LLM, and the system prompt forbids answering outside the provided excerpts as a hallucination guard. Answers stream token-by-token via Server-Sent Events and always cite the source page number.

Note: This pipeline applies only to ISBN-indexed books; lessons and ISBN-less books use a separate lightweight fallback (see slide 43).

Semantic Search

Meaning match, not just keyword match

Traditional Search

Keyword Match

Search: "Machine Learning"
❌ Misses "AI Basics"

Learnova

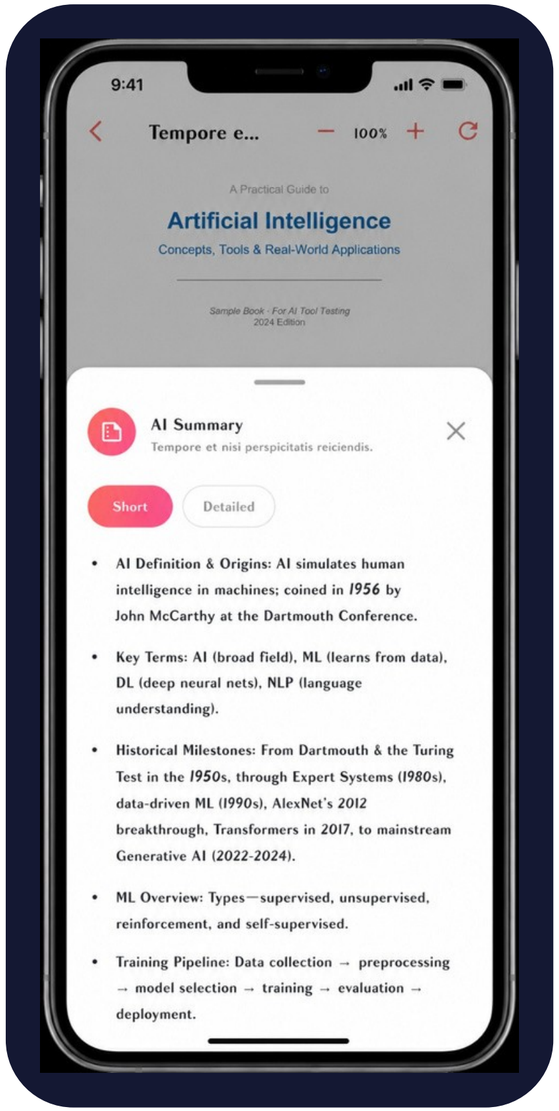
Meaning Match

Search: "Machine Learning"
✅ AI Fundamentals
✅ Deep Learning
✅ Neural Networks

Two-stage pipeline: an all-mpnet-base-v2 bi-encoder retrieves the top 50 candidates from Pinecone, then a ms-marco-MiniLM cross-encoder re-ranks them to the final top 10 — with Redis caching results for 60 seconds.

AI Summarization

Turning long books into digestible insights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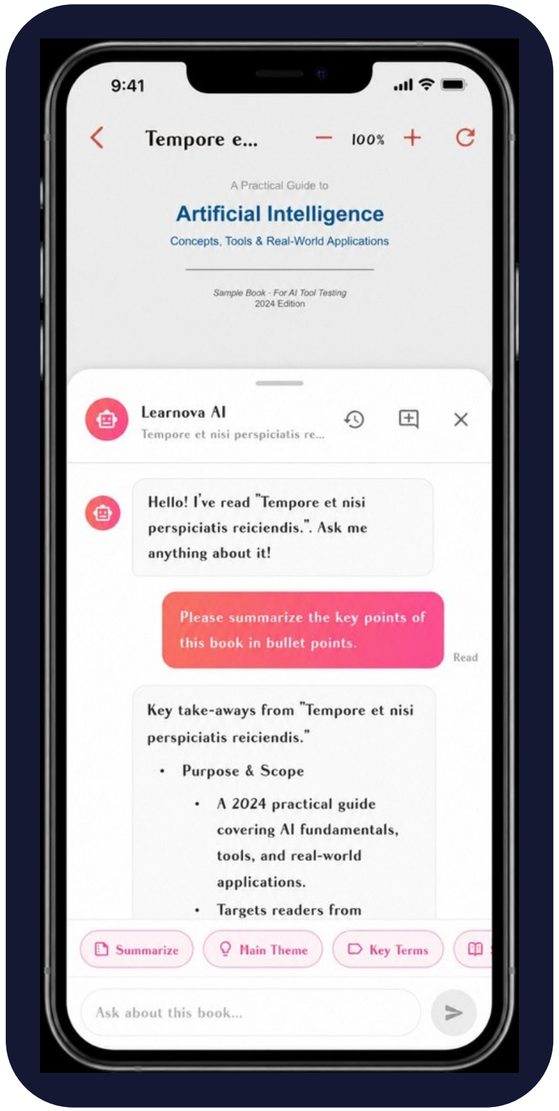
Tempore e...
100%
A Practical Guide to
Artificial Intelligence
Concepts, Tools & Real-World Applications
Sample Book · For AI Tool Testing
2024 Edition
AI Summary
Tempore et nisi perspicitatis reiciendis.
Short
Detailed
AI Definition & Origins: AI simulates human intelligence in machines; coined in 1956 by John McCarthy at the Dartmouth Conference.
Key Terms: AI (broad field), ML (learns from data), DL (deep neural nets), NLP (language understanding).
Historical Milestones: From Dartmouth & the Turing Test in the 1950s, through Expert Systems (1980s), data-driven ML (1990s), AlexNet's 2012 breakthrough, Transformers in 2017, to mainstream Generative AI (2022-2024).
ML Overview: Types—supervised, unsupervised, reinforcement, and self-supervised.
Training Pipeline: Data collection → preprocessing → model selection → training → evaluation → deployment.

- **Short & detailed summary modes**
- **Model-generated key ideas**
- **Faster reading & revision**
- **Chapter-level summaries**

AI Chat — Book Assistant

Conversational Q&A grounded in the book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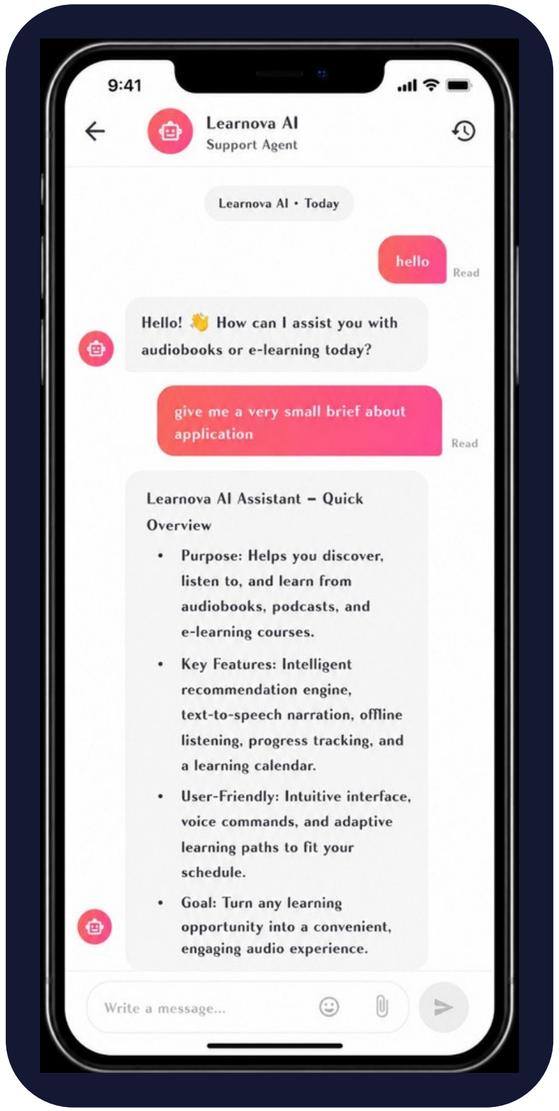
A Practical Guide to
Artificial Intelligence
Concepts, Tools & Real-World Applications
Sample Book · For AI Tool Testing
2024 Edition
Learnova AI
Tempore et nisi perspiciatis re...
Hello! I've read "Tempore et nisi perspiciatis reiciendis.". Ask me anything about it!
Please summarize the key points of this book in bullet points.
Read
Key take-aways from "Tempore et nisi perspiciatis reiciendis."
Purpose & Scope
A 2024 practical guide covering AI fundamentals, tools, and real-world applications.
Targets readers from
Summarize
Main Theme
Key Terms
Ask about this book...

- **Context-aware answers**
- **Grounded in the book's own content**
- **Quick-action prompts (Summarize, Key Terms)**
- **Fast, RAG-based responses**

AI Chatbot — General Assistant

A support agent for the whole platform


9:41
Learnova AI
Support Agent
Learnova AI • Today
hello
Read
Hello! 👋 How can I assist you with audiobooks or e-learning today?
give me a very small brief about application
Read
Learnova AI Assistant – Quick Overview
Purpose: Helps you discover, listen to, and learn from audiobooks, podcasts, and e-learning courses.
Key Features: Intelligent recommendation engine, text-to-speech narration, offline listening, progress tracking, and a learning calendar.
User-Friendly: Intuitive interface, voice commands, and adaptive learning paths to fit your schedule.
Goal: Turn any learning opportunity into a convenient, engaging audio experience.
Write a message...

- **Always-available support agent**
- **Guidance on audiobooks & courses**
- **Natural conversational interface**
- **Helps users discover content**

Hybrid Recommendation Engine

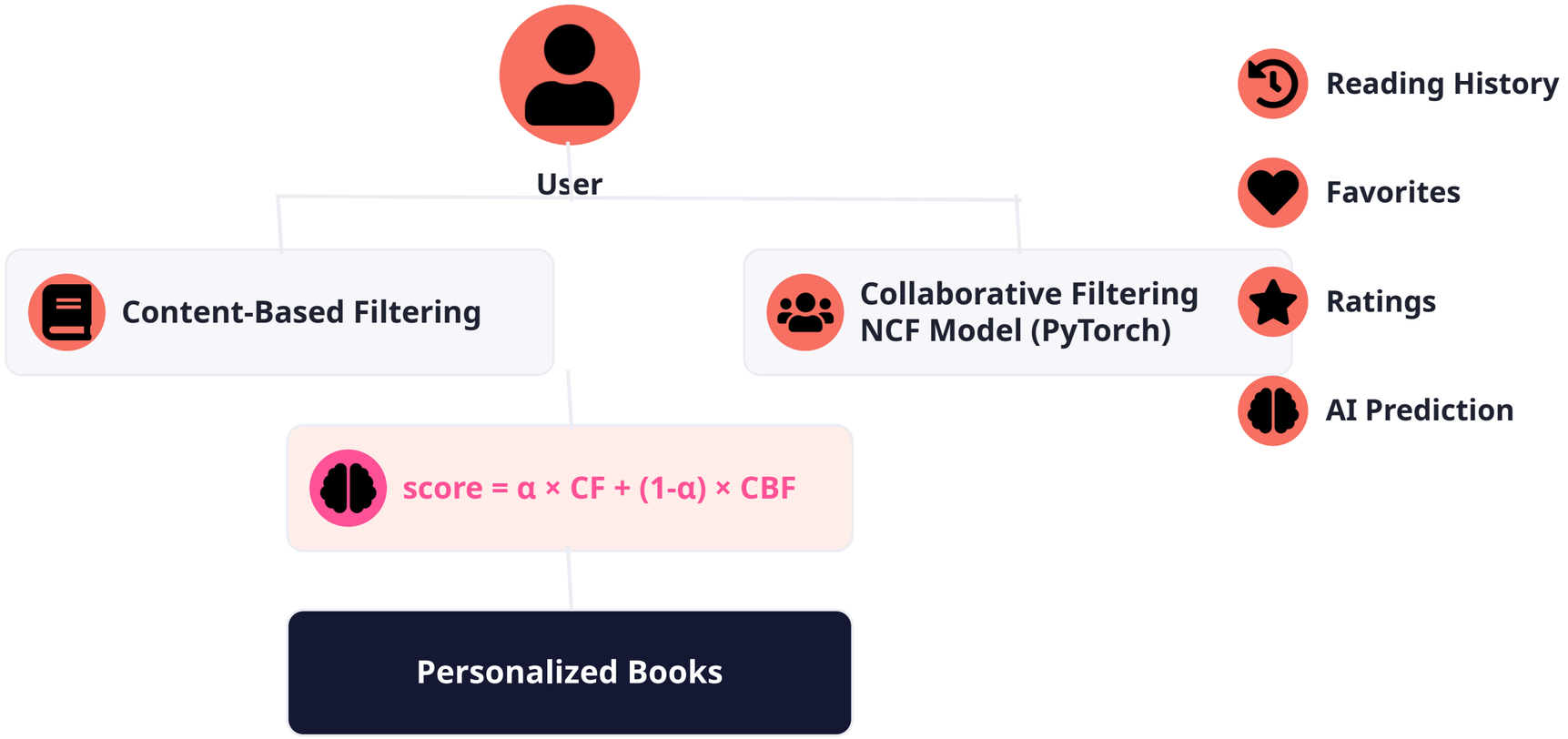
Combining content and behavior signals

Fusion Weight by User Tier

New (< 5 events)
α = 0.10

Returning (5–49)
α = 0.55

Power (50+)
α = 0.80



AI Models & Technologies

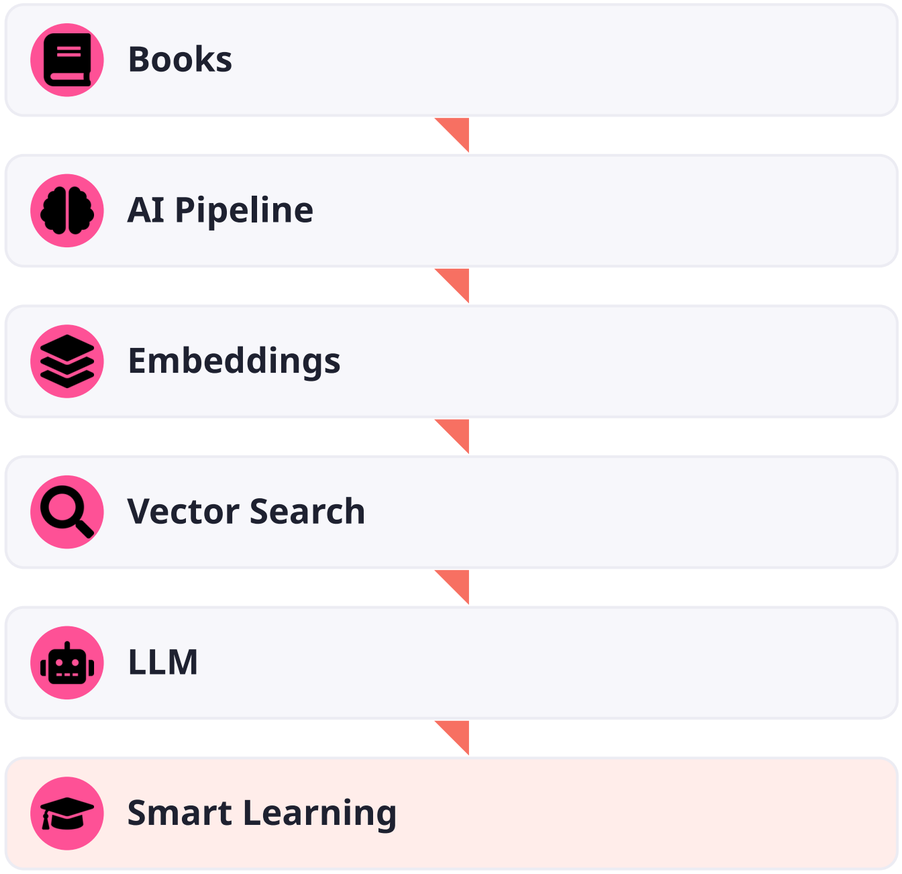
The models and infrastructure behind the AI engine

Component	Purpose
all-mpnet-base-v2	768-d sentence embeddings for search, RAG & recommendations
Pinecone	Vector index for semantic search, RAG context & similarity
Apache Kafka	Async pipeline: ingestion → embedding → indexing
FLAN-T5-large	Map-reduce book summarization & mind maps
Llama-3.3-70B (Groq)	RAG question answering via LangChain, SSE streaming
ms-marco-MiniLM cross-encoder	Re-ranking search results for precision
NCF + CBF (PyTorch)	Hybrid personalized recommendation engine
Whisper (small)	Course lesson video transcription
openai/gpt-oss-20b (OpenRouter)	Lightweight fallback chat & summarization — course lessons and ISBN-less books

Only technologies actually implemented in the platform are listed.

AI Engine Summary

From raw books to smart learning



Delivered Capabilities

- AI Chat
- AI Summary
- Semantic Search
- Recommendations

05

Results & Evaluation

From Development to Real Impact

Testing | Demo | Achievements | Future Work

Testing Strategy

Validating quality across the stack

Unit Testing

Backend services & API validation

Integration Testing

Flutter + Laravel + AI APIs

User Testing

Navigation & UI experience

Performance Testing

API response & search speed

Development → **Testing** → **Bug Fixing** → **Deployment**

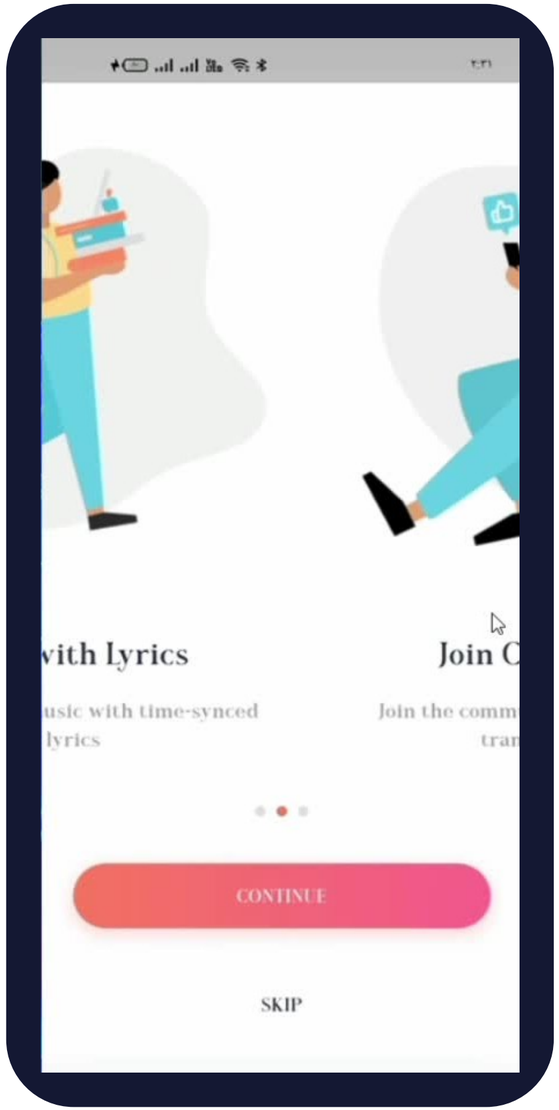
Challenges & Solutions

Engineering decisions made along the way

Challenge	Solution
Large PDFs / EPUBs	Chunking + embedding pipeline
Slow keyword search	Pinecone vector-based semantic search
AI hallucination risk	RAG grounded in retrieved book content
Large audio files	Mini player with streaming playback
API security	Laravel Sanctum token authentication

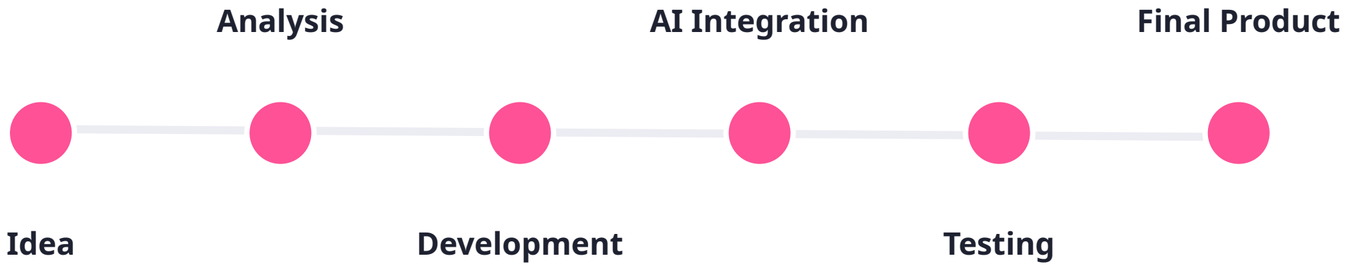
Project Demo

Complete end-to-end user journey



Project Achievements

The journey from concept to final product



Highlights

Full-stack platform: Flutter, Laravel, Python AI

Five working AI microservices

Cross-platform mobile delivery

Secure, token-based API layer

Future Work

Where Learnova goes next

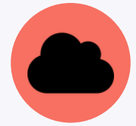
Multi-language Support

Voice Assistant

OCR for Scanned Books

Learning Analytics Dashboard

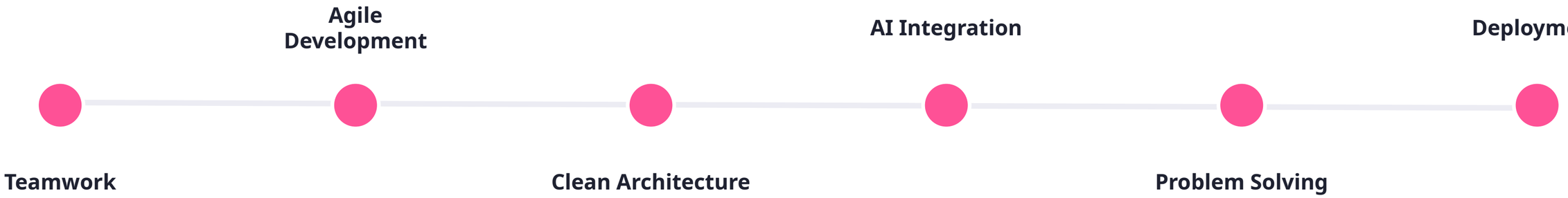
Improved Recommendation Models



Cloud Deployment

Lessons Learned

What the team takes forward



01

Teamwork

02

Agile Development

03

Clean Architecture

04

AI Integration

05

Problem Solving

06

Deployment

Project Team

Six members across three specialised groups

Flutter Team

Hend Mohamed Ahmed

Wafaa Yousry Ahmed

Backend Team

Reham Ehab El-Sayed

Salma Ibrahim Ali

AI Integration Team

Mariam Mohamed Abdullah

Norhan Abdelrahman Fathy

Supervised by **Dr. Sayed Noah** — Faculty of Engineering, Al-Azhar University

Conclusion

Learnova

AI-Powered Audiobook & E-Learning Platform

Key Contributions

- AI Chat
- Semantic Search
- AI Summary
- Hybrid Recommendation
- Audiobooks
- Courses

Thank You

Questions?

Learnova

GitHub Repository

Live Demo QR

Full Documentation

Supervised by Dr. Sayed Noah — Faculty of Engineering, Al-Azhar University

Questions & Discussion